

Isaacs (C. E.)

ON THE  
EXTENT OF THE PLEURA ABOVE THE CLAVICLE.

By C. E. ISAACS, M.D.,

DEMONSTRATOR OF ANATOMY IN THE UNIVERSITY OF THE CITY OF NEW YORK,  
CONSULTING SURGEON TO BLACKWELL'S ISLAND HOSPITAL, ETC., ETC.

READ APRIL 1, 1857.

29564

If the question were asked of any well-informed physician or surgeon, What is the extent of the pleura above the clavicle, or, what are the height and width of the pleural sac in that situation? he would probably answer, that the pleura generally rises about an inch, or perhaps even an inch and a half, above the first rib; that its width here was variable or uncertain; and that he was not even sure that it usually reached above the clavicle, and if so, only to a slight extent. I shall here quote some of the best anatomical authorities, in order to exhibit the present state of information upon this subject.

In speaking of the upper portion of the pleura, Horner says: "In proceeding along the first rib, which is very oblique, it forms a sort of bulging bag, which projects towards the trachea, lines the lower part of the scalenus anticus muscle, and receives the upper extremity of the lung. In order to understand well the position of the pleura, it must be borne in mind that the upper rib is placed very obliquely downward and forward, at an angle of forty-five degrees with the spine—consequently the pleura, on being reflected from its whole internal edge, is much higher at the head of the rib than it is at the

anterior extremity of the same.”—*Horner's Anat.*, vol. ii., pp. 165-7.

According to Cruvelhier, “the pleura above is reflected beneath the first rib, and terminates in a cul de sac, intended for the reception of the apex of the lung, and projecting more or less above that rib.”—*Cruvelhier*, vol. i., p. 549.

Sharpey and Quain state that “the upper part of the pleura, which receives the apex of the corresponding lung, projects, in the form of a cul de sac, through the superior aperture of the thorax, into the neck, reaching an inch, or even an inch and a half above the margin of the first rib, and passing up between the lower end of the scaleni muscles—a small slip of which, arising from the transverse process of the last cervical vertebra, is described by Mr. Sibson as expanding into a dome-like aponeurosis or fascia, which covers or strengthens the pleural cul de sac, and is attached to the whole of the inner edge of the first rib. The right pleura is generally stated to reach higher in the neck than the left; but in 20 cases recorded by Mr. Hutchinson, the right lung was higher than the left in 10 cases, and the left higher than the right in 8, while in 2 the height was equal on the two sides. Owing to the height of the diaphragm on the right side, the right pleural sac is shorter than the left; it is at the same time wider.”—Vol. ii., p. 950.

Harrison says “the pleura ascends as high as the transverse process of the sixth or seventh cervical vertebra. The pleuræ are of a conical form. The apex of each is in the neck, covered by the scalenus anticus, and the subclavian artery. The apex of the right is often higher in the neck than that of the left. The apex of the lung, when distended, rises in the neck to a height varying from one to two inches above the level of the first rib. The apex of the right is usually higher than that of the left.

According to Von Behr, “the pleura costalis projects above and over the first rib and the apex of the lung.”—*Von Behr's Anat.*, p. 219.

In Allen's *Dissector* it is stated that “the pleura is prolonged from half an inch to an inch above the first rib, where it covers the posterior surface of the lower part of the scalenus anticus

muscle, and the subclavian artery. It usually extends somewhat higher on the right side than on the left."—*Allen's Dissector*, p. 296.

Wilson remarks that "the pleura covers the thoracic surface of the vessels, at the root of the neck, extending for somewhat more than an inch above the margin of the first rib."—*Wilson's Dissector*, p. 306.

I have consulted the *Encyclopedia of Anatomy*, *Bourgery and Jacob*, *Sibson's Medical Anatomy*, the works of *Meckel*, *Hüsche*, *Theile*, *Velpeau*, *Blandin*, *Malgaigne*, and many others, without finding any more information upon the subject. Not the slightest mention is made of the extent of the pleura above the clavicle.

Having been aware, for some years past, of the great height to which the pleura sometimes extends above the clavicle, and of the practical bearing of this fact, I consulted at that time many of the works already quoted, but to my surprise met with the result already stated. As I continued occasionally to observe this arrangement of the pleura in the neck, it seemed to me that this point was of sufficient importance to demand investigation, and I shall here give the result of examination of one hundred subjects, in which I have endeavored to use all possible care and precaution, so as to ensure accuracy in every observation. The following method was adopted:

The subject being placed upon the back upon a firm table, the thorax was opened in the usual manner, by cutting through the cartilages of the ribs, and either sawing or breaking through the sternum, near its junction with the second rib. The next step was to ascertain that the body was squarely and evenly placed upon the table, the arms lying easily and evenly by the sides, and the head, neck, and upper extremities put into as natural position as possible. Care was also taken, in measuring the extent of the pleura, not to disturb the parts any more than could be avoided. One hand was then introduced into the thorax, and into the superior part of the pleural cavity, above the clavicle, and this was carefully examined. By the other hand, applied upon the skin, the opposite fingers of the hand first introduced could easily be felt through the inter-



vening tissues, and the height and width of the pleura readily ascertained and measured.

In cases where there was any doubt or difficulty in gaining the measurement, I passed with one hand long needles, firmly fixed in handles, downwards and backwards through the integuments, so as to strike the superior and lateral edges of the pleural sac, while, with the fingers of the other hand introduced into the pleural cavity, I ascertained that the needles were correctly placed. By these methods there could hardly be a possibility of error in the measurements. As the superior part of the pleural sac is generally prolonged above the first rib and clavicle, in a dome-like form, the measurements were accordingly taken with reference to its shape, and so as to ascertain the following points:

1. The height of the sternal or inner edge of the pleura above the clavicle.
2. The height of its central portion.
3. The height of its outer edge.
4. The distance of the sternal or inner edge of the pleura from the median line.
5. The distance of the outer edge of the pleura from the median line.

*[Several diagrams, and dried and recent preparations from the dead subject, were here exhibited.]*

I recorded each observation in a book, and cautiously abstained from reading, or comparing what I had written, until I had obtained the desired number of one hundred cases. This was done in order that I might not be influenced in my measurements by any preconceived notions; and I may add that some of the conclusions, to which it was impossible to arrive until after a long and tedious reckoning up of the whole number of observations, were entirely different from what I had anticipated. I have made a table of the one hundred cases, copied from the record:



## HEIGHT OF THE PLEURA ABOVE THE CLAVICLE.

## LATERAL EXTENT OF THE PLEURA ABOVE THE CLAVICLE.

SEX.	COLOR.	STERNAL OR INNER EDGE OF THE PLEURA ABOVE THE CLAVICLE.		CENTRAL PORTION OF THE PLEURA ABOVE THE CLAVICLE.		OUTER EDGE OF THE PLEURA ABOVE THE CLAVICLE.		DISTANCE OF THE STERNAL OR INNER EDGE OF THE PLEURA FROM THE MEDIAN LINE.		DISTANCE OF THE OUTER EDGE OF THE PLEURA FROM THE MEDIAN LINE.	
		Right.	Left.	Right.	Left.	Right.	Left.	Right.	Left.	Right.	Left.
52. Male	White	$\frac{3}{4}$	$\frac{1}{2}$	$1\frac{1}{2}$	1	1	$\frac{3}{4}$	1	$1\frac{1}{2}$	$3\frac{1}{2}$	$2\frac{1}{2}$
53. "	Black	$\frac{1}{2}$	1	1	$\frac{3}{4}$	$\frac{1}{2}$	$\frac{3}{4}$	$\frac{1}{2}$	$1\frac{1}{2}$	$2\frac{1}{2}$	$2\frac{1}{2}$
54. Female	White	$1\frac{1}{2}$	1	$1\frac{1}{2}$	$1\frac{1}{2}$	1	1	$1\frac{1}{2}$	$1\frac{1}{2}$	$3\frac{1}{2}$	3
55. Male	"	$\frac{1}{2}$	$\frac{3}{4}$	$1\frac{1}{2}$	1	1	1	1	$1\frac{1}{2}$	$3\frac{1}{2}$	$3\frac{1}{2}$
56. Female	"	$1\frac{1}{2}$	1	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{2}$	1	$\frac{1}{2}$	$\frac{1}{2}$	3	$2\frac{1}{2}$
57. Male	"	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	3	3
58. Female	"	$1\frac{1}{2}$	1	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{2}$	1	1	$\frac{1}{2}$	$2\frac{1}{2}$	$2\frac{1}{2}$
59. "	"	1	$\frac{1}{2}$	1	1	1	$\frac{3}{4}$	1	1	$2\frac{1}{2}$	3
60. "	"	1	$\frac{1}{2}$	$1\frac{1}{2}$	$\frac{3}{4}$	1	$\frac{3}{4}$	1	1	$2\frac{1}{2}$	$2\frac{1}{2}$
61. Male	"	$1\frac{1}{2}$	$1\frac{1}{2}$	2	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	3	3
62. "	"	1	1	$1\frac{1}{2}$	$1\frac{1}{2}$	1	$\frac{3}{4}$	0	$\frac{1}{2}$	3	3
63. "	"	$1\frac{1}{2}$	1	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{2}$	1	$\frac{3}{4}$	$\frac{1}{2}$	3	3
64. "	"	$1\frac{1}{2}$	1	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{2}$	$\frac{1}{2}$	$\frac{3}{4}$	$\frac{1}{2}$	3	3
65. Female	"	1	$\frac{3}{4}$	$1\frac{1}{2}$	1	$1\frac{1}{2}$	1	$\frac{1}{2}$	$\frac{1}{2}$	3	$3\frac{1}{2}$
66. "	"	0	$1\frac{1}{2}$	0	2	0	$1\frac{1}{2}$	1	1	$3\frac{1}{2}$	$3\frac{1}{2}$
67. Male	"	$1\frac{1}{2}$	1	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{2}$	1	$1\frac{1}{2}$	$1\frac{1}{2}$	3	3
68. Female	"	$1\frac{1}{2}$	$1\frac{1}{2}$	2	2	$1\frac{1}{2}$	$1\frac{1}{2}$	1	1	$2\frac{1}{2}$	$2\frac{1}{2}$
69. Male	Mulatto	2	1	2	$1\frac{1}{2}$	2	1	$1\frac{1}{2}$	$1\frac{1}{2}$	$2\frac{1}{2}$	3
70. Female	White	$1\frac{1}{2}$	1	2	$1\frac{1}{2}$	2	$1\frac{1}{2}$	$\frac{3}{4}$	$1\frac{1}{2}$	$2\frac{1}{2}$	$2\frac{1}{2}$
71. "	"	$1\frac{1}{2}$	1	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{2}$	$\frac{3}{4}$	$1\frac{1}{2}$	$2\frac{1}{2}$	$2\frac{1}{2}$
72. "	"	$1\frac{1}{2}$	$1\frac{1}{2}$	2	2	$1\frac{1}{2}$	$1\frac{1}{2}$	0	$\frac{1}{2}$	3	3
73. "	"	$1\frac{1}{2}$	$1\frac{1}{2}$	$2\frac{1}{2}$	$1\frac{1}{2}$	2	$1\frac{1}{2}$	$\frac{3}{4}$	1	$2\frac{1}{2}$	$2\frac{1}{2}$
74. Male	"	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{2}$	$\frac{3}{4}$	$3\frac{1}{2}$	3
75. "	"	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{2}$	2	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{2}$	1	$3\frac{1}{2}$	3
76. "	"	$1\frac{1}{2}$	$1\frac{1}{2}$	2	$1\frac{1}{2}$	2	$1\frac{1}{2}$	1	$1\frac{1}{2}$	$3\frac{1}{2}$	3
77. "	"	$2\frac{1}{2}$	$1\frac{1}{2}$	$2\frac{1}{2}$	$1\frac{1}{2}$	$2\frac{1}{2}$	2	0	$\frac{1}{2}$	$3\frac{1}{2}$	$3\frac{1}{2}$
78. "	"	$1\frac{1}{2}$	$\frac{3}{4}$	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{2}$	1	$\frac{1}{2}$	3	$2\frac{1}{2}$
79. "	"	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{2}$	2	$1\frac{1}{2}$	$1\frac{1}{2}$	1	$\frac{3}{4}$	3	3
80. Female	"	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{2}$	1	$\frac{1}{2}$	$\frac{3}{4}$	$2\frac{1}{2}$	$2\frac{1}{2}$
81. "	"	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{2}$	2	2	1	1	3	3
82. Male	"	$1\frac{1}{2}$	2	2	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{2}$	$\frac{1}{2}$	1	$3\frac{1}{2}$	$2\frac{1}{2}$
83. "	"	1	1	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{2}$	1	1	3	3
84. Female	"	$1\frac{1}{2}$	1	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{2}$	0	$\frac{1}{2}$	$2\frac{1}{2}$	$2\frac{1}{2}$
85. Male	"	$1\frac{1}{2}$	1	$1\frac{1}{2}$	$1\frac{1}{2}$	1	$1\frac{1}{2}$	$\frac{1}{2}$	1	$2\frac{1}{2}$	3
86. "	"	1	1	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{2}$	1	1	$2\frac{1}{2}$	$2\frac{1}{2}$
87. "	"	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{2}$	1	$\frac{3}{4}$	$2\frac{1}{2}$	$2\frac{1}{2}$
88. Female	"	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{2}$	0	$\frac{1}{2}$	3	3
89. "	"	$1\frac{1}{2}$	1	$1\frac{1}{2}$	$1\frac{1}{2}$	$\frac{1}{2}$	1	0	$\frac{1}{2}$	3	3
90. Male	"	$1\frac{1}{2}$	$1\frac{1}{2}$	2	$1\frac{1}{2}$	2	$\frac{3}{4}$	0	$\frac{1}{2}$	4	$3\frac{1}{2}$
91. "	"	1	$\frac{3}{4}$	$1\frac{1}{2}$	$1\frac{1}{2}$	1	1	1	$1\frac{1}{2}$	3	3
92. Female	"	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{2}$	2	$1\frac{1}{2}$	2	1	1	$3\frac{1}{2}$	$3\frac{1}{2}$
93. "	"	1	$\frac{1}{2}$	$1\frac{1}{2}$	1	$1\frac{1}{2}$	$\frac{3}{4}$	$\frac{3}{4}$	$\frac{1}{2}$	$2\frac{1}{2}$	$2\frac{1}{2}$
94. Male	"	1	1	$1\frac{1}{2}$	$1\frac{1}{2}$	1	$1\frac{1}{2}$	1	1	$2\frac{1}{2}$	$3\frac{1}{2}$
95. "	"	$1\frac{1}{2}$	1	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{2}$	$\frac{1}{2}$	1	$3\frac{1}{2}$	$3\frac{1}{2}$
96. Female	"	$1\frac{1}{2}$	1	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{2}$	1	1	0	$2\frac{1}{2}$	2
97. Male	"	$1\frac{1}{2}$	$\frac{3}{4}$	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{2}$	0	$\frac{1}{2}$	$3\frac{1}{2}$	3
98. Female	"	1	1	$1\frac{1}{2}$	$1\frac{1}{2}$	1	1	1	0	$3\frac{1}{2}$	$3\frac{1}{2}$
99. Male	Black	$\frac{3}{4}$	$\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{2}$	$\frac{1}{2}$	1	3	$3\frac{1}{2}$
100. "	White	1	1	2	$1\frac{1}{2}$	$1\frac{1}{2}$	1	0	$\frac{1}{2}$	4	4

## REMARKS.

In No. 4, the pleura on the right side extended  $1\frac{1}{2}$  inches to the left of the median line.

In No. 7, the pleura on the left side was only a little above the first rib.

In No. 8, the pleura on each side was only slightly above the first rib.

In No. 22, the right pleura extended one inch to the left of the median line.

In case 23, the right pleura extended half an inch to the left of the median line.

In No. 27, the right pleura extended  $\frac{1}{2}$  of an inch to the left of the median line.

In No. 34, the pleura extended upwards only to the upper margin of the clavicles.

No. 35 was similar to 34.



In No. 41, the pleura on the right side extended one inch to the left of the median line.  
 In No. 42, the pleura on the right side extended  $\frac{3}{4}$  of an inch to the left of the median line.  
 In No. 43, the pleura on the right side extended one inch to the left of the median line.  
 In No. 46, the pleura on the right side extended  $\frac{3}{4}$  of an inch to the left of the median line.  
 In No. 49, the pleura on the right side extended one inch and a quarter to the left of the median line.  
 In No. 51, the pleura on the right side extended half an inch to the left of the median line.  
 In No. 54, the right pleura extended one inch and a quarter to the left of the median line.  
 In No. 55, the right pleura extended one inch to the left of the median line.  
 In No. 66, the pleura on the right side did not rise above the superior margin of the clavicle.  
 In No. 67, the pleura on the right side extended one inch and a quarter to the left of the median line.

AVERAGE EXTENT OF THE PLEURA, ABOVE THE CLAVICLE, IN  
 100 SUBJECTS.

HEIGHT OF THE PLEURA ABOVE THE CLAVICLE.				LATERAL EXTENT OF THE PLEURA ABOVE THE CLAVICLE.			
Sternal or Inner Edge of the Pleura above the Clavicle.	Right.	Left.	Central portion of the Pleura above the Clavicle.	Outer Edge of the Pleura above the Clavicle.	Distance of the Sternal or Inner Edge of the Pleura from the Median Line.	Distance of the Outer Edge of the Pleura from the Median Line.	Width of the Pleura above the Clavicle.
	1.19	0.95					
The pleura on the right side is higher than on the left by 0.24, or rather less than $\frac{1}{4}$ of an inch.			The pleura is higher on the right side by 0.19, or nearly 1.5 of an inch.	The pleura is higher on the right side by 0.16, or about $\frac{1}{4}$ of an inch.	The difference between the two sides is only $\frac{1}{100}$ of an inch.		The pleura is wider on the right side by 0.87 of an inch.
Distance of the Sternal or Inner Edge of the Pleura from the Median Line.	Right.	Left.	Distance of the Sternal or Inner Edge of the Pleura from the Median Line.	Distance of the Outer Edge of the Pleura from the Median Line.	Distance of the Sternal or Inner Edge of the Pleura from the Median Line.	Distance of the Outer Edge of the Pleura from the Median Line.	Width of the Pleura above the Clavicle.
	0.46	0.88					
				The inner edge of the pleura is nearer to the median line on the right side by 0.42 of an inch.			
				The difference between the two sides is only $\frac{1}{100}$ of an inch.			
				The pleura is wider on the right side by 0.87 of an inch.			

**COMPARATIVE HEIGHT AND WIDTH**  
OF THE PLEURA ABOVE THE CLAVICLE, IN THE MALE AND THE  
FEMALE, CALCULATED FROM MEASUREMENTS IN 47 MALES AND  
47 FEMALES.

HEIGHT OF THE PLEURA.						WIDTH OF THE PLEURA.			
Sex.	Sternal Edge of the Pleura.		Central Portion of the Pleura.		Outer Edge of the Pleura.				
	Right.	Left.	Right.	Left.	Right.	Left.	Right. Left.		
Male....	1.23	1.042	1.53	1.29	1.25	0.35	2.64 2.06		
Female..	1.12	0.85	1.40	1.21	1.14	0.97	2.36 1.93		
		The pleura, in the male, is 0.11 higher on the right side, and 0.192 on the left.		The pleura, in the male, is 0.13 higher on the right side, and .08 on the left.		The pleura, in the male, is 0.11 higher on the right side; but on the left side it is higher in the female by 0.12.		The pleura, in the male, is 0.48 wider on the right side, and on the left by 0.13 of an inch.	

It is thus seen, from these measurements, that the pleura in the male is not only *higher*, above the clavicle, but also *wider*, in that situation, than it is in the female.

Before presenting this table, however, I may here remark that the top or upper extremity of the pleural cavity does not present a regular or dome-like form in all instances, as is described by anatomical authorities. On the contrary, it sometimes forms culs de sacs, which extend upwards, like the fingers of a glove, into the recesses of the neck. Sometimes, also, these are prolonged laterally from the right pleura, extending across the median line to the left side, and pass upwards, either between the bodies of the cervical vertebræ and the œsophagus, or between the œsophagus and the trachea.

I exhibit here:

1. A TABLE OF 100 CASES.
2. *Average* TABLE.
3. TABLE OF THE HEIGHT AND WIDTH OF THE PLEURA, IN THE  
*male and female.*



4. THE *high* EXTENT OF THE PLEURA.
5. THE *low* EXTENT OF THE PLEURA.
6. THE *sternal* EDGE OF THE *right* PLEURA.

*High Extent of the Pleura.*

In 14 cases, the pleura on the right side rose to the height of two inches and upwards above the clavicle, and in only one of these cases to two inches and a half, which was the greatest height observed in any instance. In 5 cases only, the pleura on the left side rose to the height of two inches. In 4 cases, the pleura on both sides extended to the height of two inches and upwards above the clavicle. It will thus be seen that, in 100 cases, the pleura rose two inches and upwards above the clavicle, in 14 cases on the right side, in 4 on the left, and on both sides in 5—in all, 23 cases—thus giving in 100, the proportion of nearly one in four.

I have repeatedly shown several of these cases to Drs. Wm. H. Van Buren, George A. Peters, J. W. S. Gouley, George T. Elliot, James M. Minor of Brooklyn, and many others, who were satisfied, from their own examinations of the subjects, that the measurements were correctly made, and as stated in this paper. I beg leave to express here my thanks to my friend, Dr. Gouley, for his valuable assistance in the measurement of many subjects.

*Low Extent of the Pleura.*

There were only five cases in which the pleura did not rise above the superior margin of the clavicle. In No. 7 (a white male), the pleura on the right side was of the usual height, but on the left it only rose a little above the first rib. In No. 8 (a white female), the pleuræ on both sides were only slightly above the first rib. In No. 34 (a white female), both pleuræ only reached the upper margin of the clavicle. In No. 35 (a white male) a similar arrangement existed. In No. 66, the pleura on the right side extended to the upper margin of the

clavicle; on the left it was higher than usual. This was in a white female.

*Sternal Edge of the Right Pleura.*

The sternal or inner edge of the pleura on the *right* side, extended across and to the left of the median line in 11 cases. Thus it was to the left of the median line—

In case	4.....	$1\frac{1}{2}$	inches.
	22.....	$\frac{1}{2}$	"
	27.....	$\frac{3}{4}$	"
	41.....	1	"
	42.....	$\frac{5}{8}$	"
	43.....	1	"
	46.....	$\frac{1}{4}$	"
	49.....	$1\frac{1}{2}$	"
	51.....	$\frac{1}{2}$	"
	54.....	$1\frac{1}{2}$	"
	55.....	1	"

These cases are necessarily included in the calculation of the width of the pleura, in the whole number of subjects. In these 11 cases, if we measure from the sternal, or rather inner edge of the pleura, to its outer margin, we obtain the width of the pleural sac in this situation. Owing to its inner edge extending across the median line, and to the opposite side, the width of the pleura was unusually great in these cases. It is recorded in inches and decimals. It was—

In case	1.....	4.25
"	2.....	4.25
"	3.....	3.75
"	4.....	4.
"	5.....	3.66
"	6.....	4.
"	7.....	4.25
"	8.....	4.
"	9.....	3.75
"	10.....	4.50
"	11.....	4.
		<hr/>
		44.11

The average width of the pleura in these 11 cases was 4 inches. This fact is important in reference to the surgery of this region, as, in 100 cases, one in every 9 presented the peculiarity of great width of pleura.

It has thus been shown that, in 100 cases, the pleura rose only to the upper margin of the clavicle, or very slightly above it, in 5 instances; that in 11 cases the right pleural sac extended across and to the left of the median line, making an average width of the pleura, at this point, of four inches; that a similar arrangement never was observed on the left side; that in 23 cases the pleura ran high, extending two inches and upwards above the clavicle, thus giving an average proportion of one in four; that in 14 instances this occurred on the right side, and in only 5 cases on the left, and on both sides in 4; that in one case only, the pleura attained the height of two and a half inches above the clavicle; and that the height and width of the pleura are both greater in the male than in the female. These facts, then, are of value to the physician, because the apex of the lungs corresponds with the concavity of the pleural sac above the clavicle, and it is important for him to ascertain its extent, if practicable, by auscultation and percussion. They are also useful to the surgeon, in the removal of tumors, and in other operations in this region.

In addition to what may possibly be discovered by auscultation and percussion, are there any other means of ascertaining the height of the pleura during life? I may mention that I have generally noticed that the pleura rises highest in those who have long necks, while the reverse is the case in short, and especially bull-necked subjects. I regret that I have not kept a full record of cases, with reference to this point. I find, however, in looking over my notes, 12 cases marked as having long necks, and in 10 of these the pleura was high. In 11 short-necked subjects, the pleura was very low in 3, and in the remaining 8 was below the average height.

In connection with some facts already stated, I may ask, Is it not possible that certain cases of death from operations in the lower part of the neck have been attributed to the entrance of air into the veins, when, in reality, the pleural



cavity has been opened? If this had been done at a point two inches or more above the clavicle, it would have been supposed that it was here too high for the pleura to be wounded. The knowledge of the fact that penetrating instruments or gun-shot can enter the pleura at the point just mentioned, may be of service in the diagnosis, prognosis, and treatment of such injuries, and also in cases of medical jurisprudence.

I now proceed to speak of a most important point in the surgical anatomy of the upper portion of the pleural sac, which is its relation with the subclavian artery. This artery, for the purpose of description, may be divided into three portions :

1st. That part of it which, on the right side, extends from the bifurcation of the arteria innominata, or on the left, from the arch of the aorta, to the inner margin of the scalenus anticus muscle. This portion of the artery is said to be *within* the scalenus anticus muscle, or *inside* of the same muscle. This portion of the artery *always* rests on the pleura, and this fact adds much to the difficulty and danger of ligating the artery at this point. The anatomy of the subclavian arteries within the scaleni muscles, is more complicated than that of any other surgical region of the human body. Notwithstanding the difficulty and danger of ligating the artery in this situation, it has been tied, on the right side, firstly by Colles, next by Dr. Valentine Mott, whose operations on the arteria innominata, the common, external, and internal iliac, and other great arteries, are forever recorded among the most brilliant achievements and triumphs of surgery.

The subclavian was afterwards ligatured by Hayden, O'Reilly, Partridge, Liston, and Auvert. This operation has been performed nine times, but has never succeeded, owing to the great number of anastomosing branches sent off from the artery, and which do not allow of the formation of an internal clot, but more especially from the extension of the aneurismal disease to the coats of the artery at the point of ligature, and the consequent occurrence of secondary hemorrhage.

In addition to the complicated relations of the artery on the right side, we find that the *left* subclavian, within the scaleni, is more deeply seated, and is in dangerous proximity to the thoracic duct. *The left subclavian has only once been ligatured within the scaleni muscles.* This exceedingly difficult and dangerous operation, which reflects so much credit upon American surgery, was performed by Dr. J. Kearny Rodgers, in the New York Hospital, in 1845. An account of it was published in the New York Journal of Medicine, in the March No. of 1846. It is much to be regretted that this operation, like the others upon the right side, did not succeed.

2d. The second portion of the subclavian artery is that which lies between the scaleni muscles, or under the scalenus anticus. This muscle and the artery are always, at this point, in contact with the pleura.

The artery has been tied successfully, in this situation, by Dupuytren, Liston, and Warren, of Boston.

3d. The third portion of the subclavian artery, which is the one commonly ligated for axillary aneurism, extends from the outer edge of the scalenus anticus to the lower margin of the first rib. The brachial plexus of nerves is above, and to the outside of the artery—the subclavian vein is behind the clavicle, and anterior to the artery. The artery, in this third portion of its course, does not rest upon the pleura; and yet it is a fact, not mentioned by anatomical authorities, but which I have often had occasion to notice, and which any one can easily verify for himself, that when the pleura rises high in the neck, above the clavicle, it carries with it the subclavian artery. Throughout its whole course, therefore, this artery will correspond with the height of the pleural sac in this situation. Now, in the twenty-three cases mentioned in this paper, the subclavian artery was high in the neck, and in many of them this artery, in the third portion of its course, rested upon the pleura for a very considerable extent.

I shall give the recorded measurements only of a few cases:

1. In one case in which the pleura rose very high in the neck, I found that one inch and a quarter of the right carotid, three-fourths of an inch of the left carotid, and one inch and a

quarter of the third portion of the right subclavian, extending from the outer margin of the scalenus anticus to the upper edge of the first rib, rested upon the pleura.

2. The third portion of the right subclavian, to the extent of one inch, was in contact with the pleura.

3. The third portion of the right subclavian, to the extent of one inch and five-eighths, rested upon the pleura.

4. The third portion of the right subclavian was in contact with the pleura to the extent of one inch and a quarter.

5. The third portion of the left subclavian, to the extent of one inch and five-eighths, rested upon the pleura.

I have often taken measurements of similar cases, of which, however, the notes have not been preserved.

It is on the right side that we most frequently meet with a high arrangement of the pleura, and a corresponding elevation of the subclavian artery; inasmuch as in one hundred cases the pleura was high above the clavicle in twenty-three. In all instances, as is well known, the areolar tissue, of variable firmness and density, intervenes between the subclavian artery and the pleura. Notwithstanding this, should an operator who was unaware of this occasional relation of the artery to the pleura, attempt to pass an aneurism-needle around it in this situation, without due caution, he might easily tear or open into the cavity of the pleura. It is not improbable that this accident may have occurred, and caused a sudden and fatal termination, which was attributed to entrance of air into the veins.

The facts, then, which have just been stated, are evidently of great importance, yet I find, on consulting the anatomical writers already quoted, nothing satisfactory upon this subject. Nor have I been more successful in obtaining information from the surgical works of Malgaigne, Velpeau, Blandin, Sedillot, Chelius, Pirrie, Miller, the Coopers, Gibson, Ferguson, Syme, Liston, Druit, Bourguery, and many others.

In Mr. Guthrie's work on the arteries, I find the following remark, while speaking of the ligature of the third portion of the subclavian: "The aneurism-needle should be passed from below upwards, by which the pleura will be avoided." (*Arteries*, p. 39.) From this observation, it would seem that he con-



siders that the artery is constantly in contact with the pleura in this situation, which, however, is far from being the case. The caution which he advises is, nevertheless, very necessary, inasmuch as we have seen that the artery is high in the neck, in about the proportion of one in four cases, and would then rest upon the pleura.

Mr. Erichsen says: "One principal danger in ligaturing the subclavian artery, at any point above the first rib, certainly arises from interference with the fine cellular tissue which lies between it and the scalenus muscle, separating it from the pleura. If inflammation be excited in it, the morbid action will readily extend, by mere continuity of tissue, into the thorax by the anterior mediastinum, invading ultimately the pleura and pericardium. Hence, when it is practicable, the surgeon should keep the point of the needle close to that part of the artery which lies upon the first rib, as there is less risk here of opening into the deep cellular tissue of the neck."

He also states that inflammation of the contents of the thorax proved fatal in nine out of twenty-two cases of ligature of the subclavian, in the third portion of its course—the proportion of deaths being one in two and a half. This inflammation, then, is the most frequent cause of death from this operation.

He further remarks: "It will at first be supposed that, in this respect, the operations on the subclavian resembled other of the great operations of which pneumonia is so common a sequel, but, on closer examination, it will be found that this is not the case—that the inflammation attacking the thorax, or its contents, after ligature of this artery for axillary aneurism, is not confined to the lungs, but very commonly affects the pleura and pericardium, as well or even in preference to these organs. It would, therefore, appear probable that it arose from causes essentially connected with this disease or operation."

These he thinks are:

1. Inflammation of the deep cellular tissue, at the root of the neck, extending to the anterior mediastinum, pleura, and pericardium.

2. Pressure of the sac, which, by encroachment, gives rise to inflammation of the pleura.

### 3. Injury of the phrenic nerve.

The single remark of Mr. Guthrie, and those of Mr. Erichsen, comprise all the information upon this point which I have been able to collect from the writers on surgery. They say nothing about the pleura in its relation to the third portion of the subclavian artery—the part upon which a ligature is usually applied.

*In conclusion, it may be well to consider what facts and deductions have been adduced in this paper, which may be considered as new, or of an original character :*

1. A table of 100 cases has been given of the extent of the pleura above the clavicle.

2. A table of the *average* extent of the pleura in the total number of cases.

3. A table of the comparative height and width of the pleura, in the male and in the female, calculated from the measurements of 47 males and 47 females.

4. A table of the cases in which the pleura rose high above the clavicle.

5. A table of cases in which the pleura only reached the upper margin of the clavicle, or was very slightly above it.

6. A table of cases in which the sternal edge of the right pleura extended to the left, and across the median line.

7. A table of the width of the pleura, which is always unusually great in such cases.

8. The curious fact that the top of the pleural sac is not always dome-shaped, but sometimes forms culs de sacs, extending upwards, and sometimes laterally, into the recesses at the root of the neck.

9. Conclusions drawn from the occasional great height and width of the pleura, which may be valuable to the pathologist, and to the medical and surgical practitioner.

10. Conclusions drawn from the fact that the subclavian artery, in the third division of its course, occasionally rests upon, or is in contact with the pleura. This has been shown to occur in nearly one case out of four.

11. That the pleura rises high in the neck, above the clavicle,

in long-necked persons ; and, on the contrary, is low in short-necked, and especially in very bull-necked subjects.

12. Finally, it is believed that the facts and deductions which have been stated in this paper, may be found to be interesting in an anatomical, physiological, and pathological point of view, and of some utility in the practice of medicine and surgery, and in cases of medical jurisprudence ; and with this hope, they are respectfully submitted to the better judgment of this Academy.



